

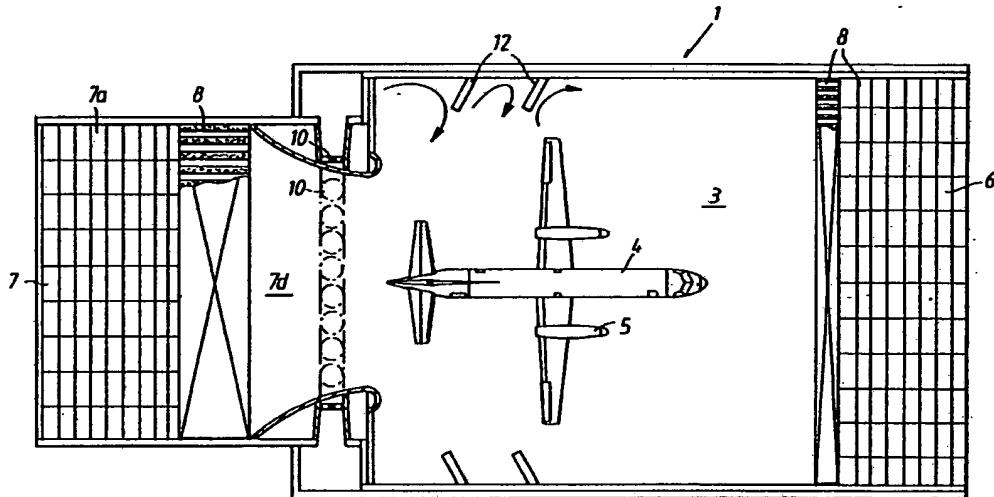


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(54) Title: A TESTING BUILDING FOR TESTING AIRCRAFT ENGINES, PARTICULARLY OF PROPELLER TYPE



## (57) Abstract

The invention refers to a building for testing aircraft engines, particularly of propeller type, and comprising vertical walls and a roof which on a ground surface (2) delimit a closed test hall (3) in which the aircraft (4), the engine or engines (5) of which are to be tested, is adapted to be parked and with air inlet and outlet ducts (6, 7) provided with silencing baffles (8) and extending substantially horizontally forwardly and rearwardly of the parked aircraft (4), respectively, and which have an adjoining inlet and outlet portion (6a, 7a), respectively, which is directed substantially vertically. In order to provide that the airflows in the test hall effectively are taken care of and a laminar and stable airflow might be maintained, it is suggested according to the invention that the air outlet duct (7) has diffusor shape in its portion located closest to the test hall (3).

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A testing building for testing aircraft engines, particularly of propeller type

The present invention refers to a building for ground testing of aircraft engines, particularly of turbo-prop type, and comprising vertical walls and a roof, which on a ground surface delimit a closed test hall, in which the aircraft is to be placed, the engine or engines of which is/are to be tested, and air inlet and outlet ducts equipped with silencing baffles and extending substantially horizontally forwardly and rearwardly of the parked aircraft, respectively, and which have an adjoining inlet and outlet portion, respectively, directed in substantially vertical direction.

Ground testing of aircrafts most often is made outdoors and in unprotected environment. In doing so problems arise particularly in the form of noise which is disturbing to surrounding houses and the ever-increasing environment requirements therefore have led to a frequent location of the aircraft engine testing places at great distance from the workshops and other facilities at the airports. In its turn this requires extensive and time-consuming transports which constitute a basic problem which possibly could be solved by means of a suitable testing building. Such testing buildings have been utilized to a small extent in connection with military aircrafts with turbojet engines but due to the concentrated character of the jets it is relatively simple to collect and cool such jets and damp the noise therefrom.

In propeller-driven aircrafts the situation is different in that substantial technical difficulties have to be overcome which are associated with the great air flows which are difficult to control and occur in a limited test hall due to the great air volumes which furthermore varies from one operational case to another. Said air flows might give rise to sound amplifications in the form of acoustic resonances which influence on the aircraft in the form of vibrations. In order to avoid a re-circulation

of air flows in the test hall the under-atmospheric pressure therein ought not to exceed 20 mm water column. Behind an aircraft propeller a helical air flow with low speed occurs which "circulates" in the test hall.

Now, the object of the present invention is to provide a testing building in which the air flows in the test hall can be effectively taken care of and a laminar and stable air flow can be maintained. This is obtained according to the invention substantially in that the air outlet duct in its portion closest to the testing hall has diffusor shape.

With the invention an increased pressure recovery is obtained in the diffusor which implies an improved damping of noise and elimination of the re-circulation. In order to secure that engine exhausts, particularly in tests with low propeller effect, are re-circulated in the hall it is furthermore suggested according to the invention that in the diffusor-shaped air outlet suction fans are arranged, which act transversely to the outlet direction. By the provision of protruding and guiding wall blades or portions at the inner surface of walls and roof further obstacles are obtained which prevent the re-circulation of air which possibly is contaminated with engine exhaust gases.

By way of example the invention will be further described below with reference to the accompanying drawings, in which Fig. 1 is a cross-sectional side view of a testing building according to the invention including an aircraft parked therein, Fig. 2 is a plan view from above of said test building with the roof omitted in order to illustrate the test hall and Fig. 3 is a detail view from above of the diffusor-shaped outlet.

In the drawings it is thus illustrated a testing building 1 having vertical walls and a roof which on a support or ground 2 delimit a closed test hall 3 in which the aircraft 4, the engine or engines 5 of which is/are to be tested, is adapted to be parked. The testing building

is provided with an air inlet duct 6 at one end of the testing building 1, which the parked aircraft 4 is to be facing with its front portion, and an air outlet duct 7 at the opposite end of the testing building 1. Both the inlet duct 6 and the outlet duct 7 is provided with noise-damping panel elements or so-called baffles 8, preferably in several sets, and furthermore the respective inlet and outlet duct 6, 7 merges in an adjoining inlet and outlet portion 6a, 7a, respectively, which both are directed substantially vertically.

According to the invention the air inlet duct 7 has diffusor shape at its end or portion 7d located closest to the rear wall of the test hall 3. Preferably the vertical rear wall at either side of the air outlet portion 7d is shaped so as to be arcuately curved, see Fig. 3, so as to form a rounded inlet to said duct portion.

Although the diffusor-shaped portion 7d of the air outlet duct 7 as previously known might be provided with guide vanes, is for minimizing the border layer within the diffusor portion and for effectively preventing re-circulation of engine exhaust gases particularly in tests with low propeller effect, according to the invention mounted a number of suction fans 10 in the diffusor portion 7d, which act in a transverse vertical plane to the building 1. The outlet air hence is forced to follow the curved shape of the diffusor which, owing thereto, might be made substantially shorter than what otherwise should have been possible.

As a further measure for preventing that air which possibly is contaminated with engine exhaust gases, whirls around in the hall and follows the walls thereof from the rear and towards the front such that said air might be sucked into the air inlets of the engines and reach the air conditioning system of the cockpit with associating health hazards to the aircraft crew, protruding and guiding wall panels or portions 12 might be mounted to the inner surface f the walls and the roof such as is parti-

cularly evident from Fig 2. Preferably said wall panels 12 are mounted at positions in the length direction of the hall 3 which are located to the rear of the engine or engines 5 of the parked aircraft.

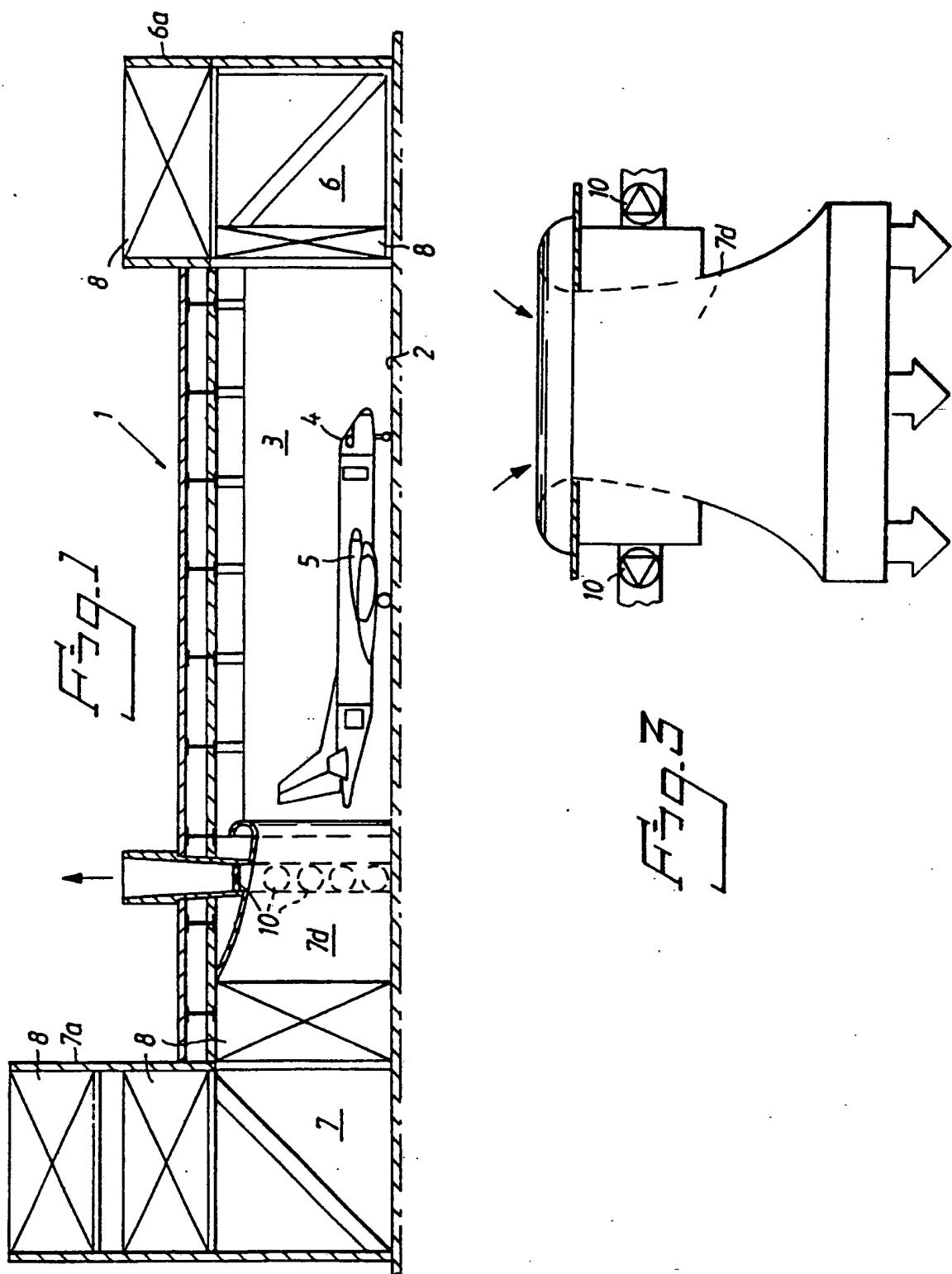
5       The sound or noise damping panel elements or baffles 8 might be of known construction and have the shape of box-like cassettes of sheet metal with perforated or apertured walls and be filled with a sound-absorbing material such as mineral wool or the like. Across the narrowest 10 cross-section of the diffusor-shaped outlet portion 7d there can also be mounted a flow-stabilizing net.

15      By aero-dynamic model tests it has been verified that the suggested design according to the invention with diffusor shape of the air outlet 7 and the rest of the suggested measures effectively solves the problems of re-circulating air flows, sound amplification, subatmospheric pressure and noise.

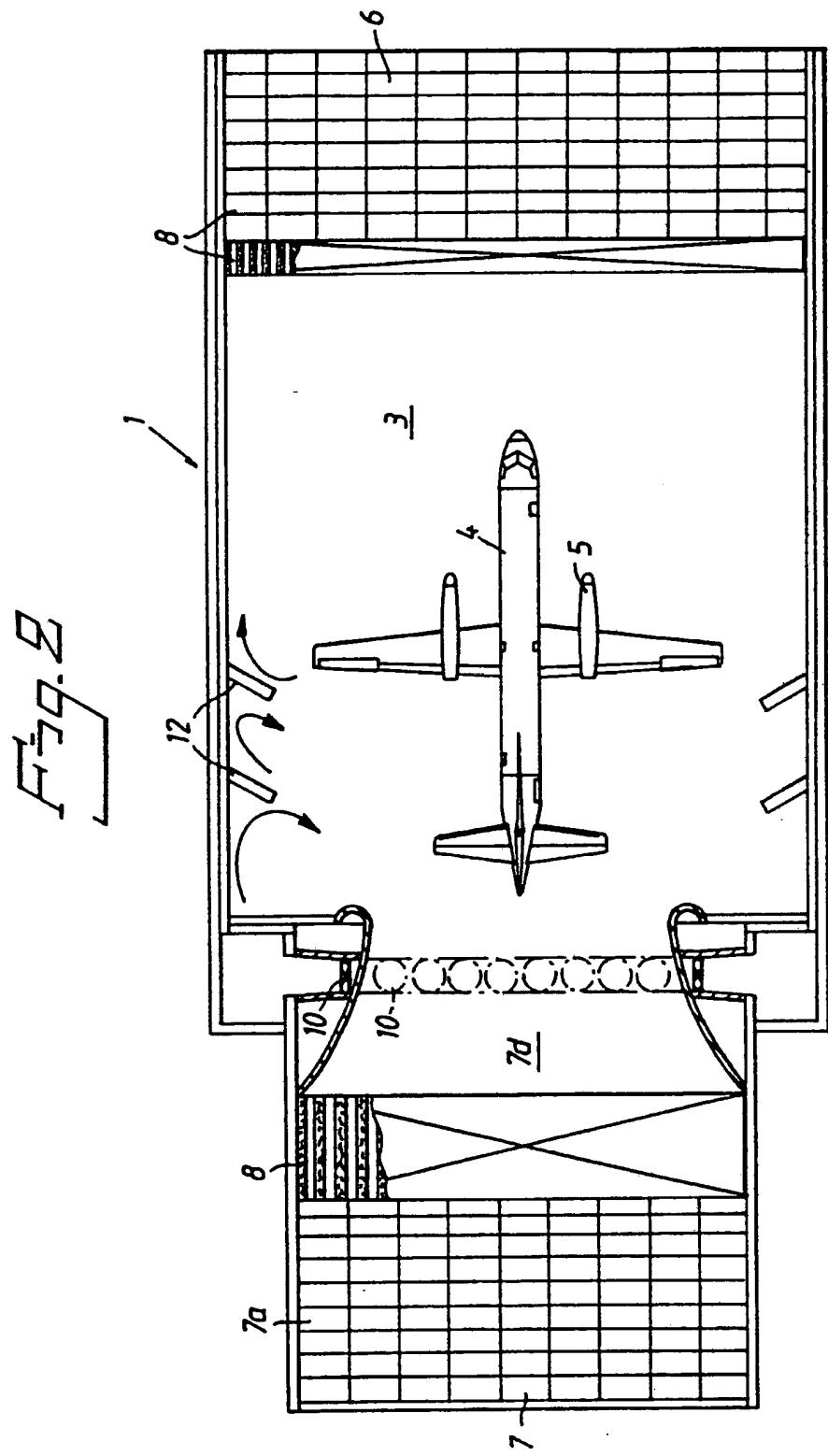
C l a i m s .

1. A testing building for testing aircraft engines, particularly of propeller type, and comprising vertical walls and a roof, which on a ground surface (2) delimit a closed test hall (3), in which the aircraft (4) is to be placed, the engine or engines of which is/are to be tested, and air inlet and outlet ducts (6, 7), which are equipped with silencing baffles (8) and which extend substantially horizontally forwardly and rearwardly of the parked aircraft (4), respectively, and which have an adjoining inlet and outlet portion (6a, 7a), respectively, directed in substantially vertical direction, characterized in that the air outlet duct (7) in its portion closest to the testing hall (3) has diffusor shape.
2. A testing building according to claim 1, characterized in that in the diffusor-shaped air outlet portion (7d) are mounted suction fans (10) acting transversely to the outlet direction.
3. A testing building according to claim 1 or 2, characterized in that interior of the walls and roof are mounted protruding guide wall panels or portions (12) in order to prevent a re-circulation of air possibly contaminated with engine exhaust gases.
4. A testing building according to claim 3, characterized in that the guide wall panels (12) are mounted at positions in the lengthwise direction of the hall 3 which lie behind the engine or engines (5) of the parked aircraft.

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00195

## A. CLASSIFICATION OF SUBJECT MATTER

IPC5: E04H 6/44, B64F 1/26

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: E04H, B64F, G10K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>Volvo Aero Support AB, S-732 82 Arboga;            "Noise suppressed run-up enclosure facility for            Jet or Propeller powered commuter aircraft",            Arboga, 1991, 8 pages</p> <p>---</p> <p>-----</p>	1

<input type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/>	See patent family annex.
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